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of the user determine this. Several would be needed for any general work. One now in use, holding 500cc., empties in five to six hours, dropping alcohol, at the rate of 50 drops per minute. This is very rapid, and the same apparatus can be made to run ten to twelve hours at least. Another containing 40cc. runs two hours, dropping at the rate of five drops per minute.

The tubes (a) and (b) must not be too long in proportion to diameter and desired flow, since the taller the apparatus the greater the difference in pressure between start and finish, which means a difference in rate of flow correspondingly, (tho not proportionally) great. A proportion of length to diameter of 3 to 1 has been found most practical. A broader one is disturbed by jarring of the apparatus, and a taller one varies considerable in rate. The mixing chamber should be at least an inch long, better an inch and a half, but may be of small diameter.

If the fluids should be imperfectly mixed when they issue from the apparatus, the unmixed portions will almost immediately arrange themselves in the container and no harm result. With a properly packed mixing chamber 95% alcohol and water may be so mixed that the resultant fluid shows no diffusion currents in the container. It has usually been found desirable however to use two fluids nearer together in density, as water and 50% alcohol, then 50% alcohol with 95% alcohol, then 95 and 100% alcohol, then 100% and a mixture of half 100% and half xylol or other oil, etc. The result is greater certainty and better efficiency in the use of the apparatus.

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AN INDIVIDUAL PARAFFIN BATH

An improved form of the Self-Regulating Paraffin Bath as designed by C. W. Woodruff, and described in the Journal of the Royal Microscopical Society for October of 1914, has been in use in the Animal Biology Laboratories at the State University of Iowa for nearly three years.

The original apparatus was made of tin, but as tin rusted so quickly other materials have been substituted. So, now the apparatus consists of a glass double cup blown in one piece, one cup being within the other separated by a distance of approximately one centimeter at the sides and two centimeters at the bottom. In addition to this cup is an ordinary 16 candle-power electric bulb, a condenser, an asbestos container, and Acetone which is the solution used as the bath.

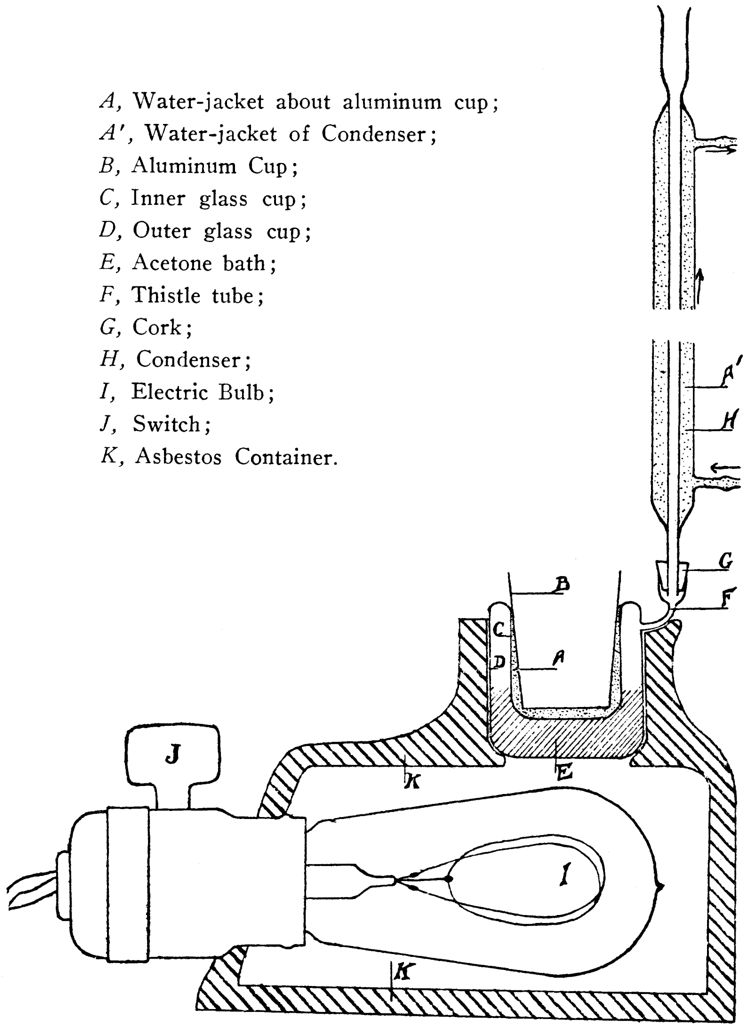
The inner glass cup is just large enough to contain an 100 c.c. aluminum cup which is removable and in which are placed the paraffin and tissues to be imbedded. Good thermal contact between the inner glass cup and the aluminum cup is made by filling the space between them with water.

The outer glass cup is connected with the condenser by means of a thistle tube which is blown into the side near the upper edge. The distal end of the thistle tube is expanded into a tube large enough to receive a No. 10 cork through which projects the condenser of the ordinary water cooled variety in common use in chemistry work. In the outer cup is placed the solution which forms the bath.

Acetone is used as the bath in preference to chloroform for the sole reason that its boiling point is 56° C. (usually about 55.5° C. or lower) while the boiling point of chloroform (Pure Chloroform for Anæsthesia) is about 58° C. and usually is slightly higher. In fact Commercial Chloroform can not be used at all as the temperature frequently exceeds 60° C. Except for the fact that Acetone is combustible while Chloroform is not, Acetone is the better solution of the two for this purpose. However in using either Acetone or Chloroform a condenser is necessary in order to keep the bath from boiling dry and burning the tissues.

The asbestos container is built of asbestos paper and shredded asbestos. Two asbestos paper cylinders are made using a bottle to give the desired size and form. Cylinder No. 1 which is to contain the electric bulb is placed in an horizontal position and an opening the size of cylinder No. 2 is cut in the upper side near one end. One end of cylinder No. 2 is cut to fit and placed in a vertical position over the aperture in the side of cylinder No. 1 and the edges sewed together. Then mixing the shredded asbestos with water it forms a paste which is moulded over the asbestos paper cylinders until the walls are quite thick.

The bottles are now removed, the electric bulb is placed in cylinder No. 1, and the ends closed with paste. The glass double cup is also placed in position in the top of cylinder No. 2, and the



A, Water-jacket about aluminum cup;
A', Water-jacket of Condenser;
B, Aluminum Cup;
C, Inner glass cup;
D, Outer glass cup;
E, Acetone bath;
F, Thistle tube;
G, Cork;
H, Condenser;
I, Electric Bulb;
J, Switch;
K, Asbestos Container.

Electric Paraffin Bath

paste carefully moulded about it. The current is now switched on and the apparatus set aside for the asbestos to dry out.

In the drying of the asbestos care must be taken that it does not crack as it shrinks a great deal in the process. In fact it is better to allow the asbestos to dry without the glass cup in position after which the container may be pared out to fit the cup. Any patching necessary may be easily and neatly done by adding asbestos paste.

In operation the outer cup is filled about half full of Acetone, the top of the condensing tube is left uncorked (it being necessary to keep it corked when the apparatus is not in use to prevent the loss of the Acetone by evaporation), the aluminum cup with its water jacket is placed in the inner glass cup and the water current in the condenser and the electricity are turned on.

In order to save time, as the temperature of the apparatus is so near the melting point of paraffin, it is better to melt the paraffin before placing it in the apparatus. Care must be taken however that the heat of the aluminum cup and paraffin does not break the glass cups. This danger can be avoided by having plenty of water in the inner cup to form the water-jacket about the aluminum cup. Also in order that the temperature remain constant it is necessary to carefully clean the cup containing the bath as constant boiling causes precipitates to be formed which raise the boiling point of the Acetone or Chloroform as the case may be.

As well as combining simplicity of mechanism, uniformity of temperature, illumination of cup and inexpensiveness as does Mr. Woodruff's apparatus, this device has a lower temperature, and greater convenience because the tissues are handled in an aluminum cup rather than by being placed directly in the apparatus. This allows greater ease in changing the paraffin and also makes it possible to dip the paper imbedding boxes into the paraffin containing the tissues so that the tissues may be placed in the embedding boxes without exposure to the air. This avoids the formation of the thin surface film of paraffin about the tissues which so often results in the tissues being loose in the block so that the sections fall out of the ribbon in process of sectioning. Also the chance of breakage is reduced to a minimum due to the breakable parts being supported and almost surrounded by the asbestos container.

The factor of safety, in one sense, is less than in Mr. Woodruff's apparatus due to the use of Acetone which forms the bath, it being a combustible material. This danger however is negligible as the solution is enclosed in a glass vessel and the heat is furnished by an electric bulb.

In another sense, that of the safety of the tissues which is the only excuse for the apparatus, the factor of safety is greater than in Mr. Woodruff's machine. This is due to the fact that the condenser eliminates the possibility of the bath evaporating to dryness and the consequent scorching of the tissues. Altogether the apparatus is very useful and one which when once used soon becomes a part of the permanent laboratory equipment.

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A MACROSCOPIC METHOD OF RECONSTRUCTION

In laboratory and research work good results can often be obtained by some make-shift application of materials already in stock which would otherwise require apparatus expensive and difficult to obtain. Such is an apparatus for the purpose of figuring to scale objects of great irregularity of form and surface which has been in use several months in the Animal Biology Laboratories of the State University of Iowa.

The apparatus is really a graphing device applying the principle of the X and Y axes, and is used in conjunction with ordinary graph paper. The materials were all found in the laboratory stock room and comprise a sliding celloidin microtome, two metric rulers, a piece of heavy wire about 18 inches long and some modelling wax.

One of the rulers, which is known as the X ruler, is fastened in a stationary position on the frame of the microtome near to the sliding knife carriage and parallel with its direction of motion. The other ruler, which is known as the Y ruler, is fastened to the sliding knife carriage in a horizontal position and at right angles to the stationary or X ruler. One end of the Y ruler overrides the X ruler, clearing it by about one-eighth of an inch.